

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

3/7/3

DIALOG(R)File 351:Derwent WPI

(c) 2004 Thomson Derwent. All rts. reserv.

014334988 \*\*Image available\*\*

WPI Acc.No: 2002-155691/200221

**Covalently and ionically crosslinked polymer preparation, for use as electrochemical and separating membranes, comprises crosslinking acid-, sulfinate- and amine-functional polymers**

Patent Assignee: UNIV STUTTGART INST CHEM VERFAHRENSTECH (UYST-N); UNIV STUTTGART (UYST-N); KERRES J (KERR-I); TANG C (TANG-I); ZHANG W (ZHAN-I)

Inventor: KERRES J; TANG C; ZHANG W

Number of Countries: 097 Number of Patents: 009

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week
-----------	------	------	-------------	------	------	------

DE 10024576	A1	20011122	DE 1024576	A	20000519	200221 B
-------------	----	----------	------------	---	----------	----------

<b>WO 200187992</b>	A2	20011122	WO 2001EP5644	A	20010517	200221
---------------------	----	----------	---------------	---	----------	--------

AU 200181776	A	20011126	AU 200181776	A	20010517	200222
--------------	---	----------	--------------	---	----------	--------

EP 1292632	A2	20030319	EP 2001960223	A	20010517	200322
------------	----	----------	---------------	---	----------	--------

			WO 2001EP5644	A	20010517	
--	--	--	---------------	---	----------	--

BR 200110876	A	20030311	BR 200110876	A	20010517	200323
--------------	---	----------	--------------	---	----------	--------

			WO 2001EP5644	A	20010517	
--	--	--	---------------	---	----------	--

KR 2003007583	A	20030123	KR 2002714862	A	20021106	200336
---------------	---	----------	---------------	---	----------	--------

CN 1433442	A	20030730	CN 2001809773	A	20010517	200365
------------	---	----------	---------------	---	----------	--------

<b>US 20030208014</b>	A1	20031106	WO 2001EP5644	A	20010517	200374
-----------------------	----	----------	---------------	---	----------	--------

			US 2003275854	A	20030512	
--	--	--	---------------	---	----------	--

JP 2003533560	W	20031111	JP 2001585209	A	20010517	200375
---------------	---	----------	---------------	---	----------	--------

			WO 2001EP5644	A	20010517	
--	--	--	---------------	---	----------	--

Priority Applications (No Type Date): DE 1024576 A 20000519.

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
-----------	------	-----	----	----------	--------------

DE 10024576	A1	11	C08J-005/24		
-------------	----	----	-------------	--	--

WO.200187992	A2	G	C08F-008/00		
--------------	----	---	-------------	--	--

Designated States (National): AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA

CH CN CO CR CU CZ DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN

IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ

PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW

Designated States (Regional): AT BE CH CY DE DK EA ES FI FR GB GH GM GR

IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW

AU 200181776	A		C08F-008/00	Based on patent WO 200187992
--------------	---	--	-------------	------------------------------

EP 1292632	A2	G	C08G-075/00	Based on patent WO 200187992
------------	----	---	-------------	------------------------------

Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT

LI LT LU LV MC MK NL PT RO SE SI TR

BR 200110876	A		C08F-008/00	Based on patent WO 200187992
--------------	---	--	-------------	------------------------------

KR 2003007583	A		C08G-075/00	
---------------	---	--	-------------	--

CN 1433442 A C08G-075/00  
US 20030208014 A1 C08F-130/04  
JP 2003533560 W 50 C08G-085/00 Based on patent WO 200187992

Abstract (Basic): DE 10024576 A1

NOVELTY - Covalently and ionically crosslinked polymers (I) are prepared by crosslinking polymers having acid groups, polymers having sulfinate groups and polymers having tertiary amine groups with polyfunctional haloalkanes or haloaromatics.

DETAILED DESCRIPTION - Covalently and ionically crosslinked polymers (I), including blends of (I) and membranes comprising (I), are prepared by crosslinking polymers having acid groups of formula (II), (III) and/or (IV), polymers having sulfinate groups of formula (V) and polymers having tertiary amine groups of formula (VI) with polyfunctional haloalkanes or haloaromatics to form crosslinks of formula (Ia)-(Ic).

SO<sub>3</sub>M (II)

PO<sub>2</sub>M<sub>2</sub> (III)

COOM (IV)

SO<sub>2</sub>M (V)

NR<sub>2</sub> (VI)

polymer-SO<sub>2</sub>-Y-polymer (Ia)

M=H, metal or ammonium;

R=alkyl, hydroxyalkyl or aryl, or NR<sub>2</sub> is pyridyl or another tertiary N-containing heteroaromatic or heterocyclic group;

X=Hal or OR;

Hal=F, Cl, Br or I;

Y=(CH<sub>2</sub>)<sub>x</sub>, arylene, (CH<sub>2</sub>)<sub>x</sub>-arylene or CH<sub>2</sub>-arylene-CH<sub>2</sub>; and

x=3-12.

An INDEPENDENT CLAIM is also included for the preparation of (I), comprising: dissolving the polymers in N,N-dimethylformamide, N,N-dimethylacetamide, N-methylpyrrolidone (NMP), dimethyl sulfoxide or sulfolane; adding the crosslinker; homogeneously dispersing the crosslinker in the polymer solution by stirring; filtering and degassing the polymer solution; spreading a thin film of the polymer solution on a substrate (e.g. a glass or metal plate or a woven or non-woven fabric); removing the solvent by heating to 80-130 degrees C and/or applying a vacuum or in a circulating-air dryer; optionally removing the film from the substrate; and treating the film in dilute (1-70%) mineral acid and then deionized water at a temperature between room temperature and 95 degrees C.

USE - Membranes comprising (I) are useful both in electrochemical applications, especially fuel cells (operating with hydrogen or methanol at 0-180 degrees C), electrochemical cells, secondary batteries and electrolysis cells, and in membrane separation processes, e.g. gas separation, pervaporation, perstraction, reverse osmosis,

electrodialysis or dialysis.

ADVANTAGE - (I) combine the hydrolytic stability of covalently crosslinked polymers with the flexibility and good water retention of ionically crosslinked polymers.